

falling barometer, tended to increase the fear. In the early evening distant vivid flashes of lightning in the north and east presaged a thunderstorm, which gradually approached us, and proved to be one of the most severe we have for a long while, if ever in Antigua, experienced, lasting nearly all night. The flashes of electricity simultaneously with the roar of Heaven's artillery, and the driving rain on our iron covered roof were to us (who think less, perhaps, of the surrounding danger than of the majesty and power of the Great I Am) a phenomenon of grandeur beyond description. Not all of us love to view nature in her unwonted guise, but all of us recognize His restraining hand at work when we contemplate the dangers that surrounded us on Thursday night and yet realize that there is comparatively little damage to report.

The casualties so far as we have ascertained fortunately include no lives. The topmast of the flagstaff at Goat Hill signal station was splintered and thrown down. The telephone posts and lines in many localities were badly damaged, the wire in some places being perfectly fused and made as brittle as a lead pencil. The line to Hill House is cut in several places, one post burnt to the ground, leaving only a charred stump, another splintered into atoms, and two split from top to bottom. In St. Johns the residence of Mrs. Dew in Bishopgate and Popeshead streets was struck on the roof toward the south. The appearance, as we saw it, was as if several sledges, chisels, and hatchets had been used to reduce the rafters, shingles, and boards to the heaps of matchwood strewn about the bedroom in which they fell. \* \* \* The fall of rain during the storm was pretty heavy. We have been favored with returns from twenty-eight stations, which give an average of 2.03 inches.

An eye witness residing near the telephone exchange says that it is impossible to describe how awfully beautiful was the sight of the electric fluid dancing in multicolored flames along the lines up and down High street. Residents at Yaptons felt themselves in imminent peril, as in that elevated locality it appeared as if balls of blue fire were all the time falling around the dwelling house; no damage there is reported, however.

#### THE STORM WAVES OF SOUTH CAROLINA AND TEXAS.

By Gen. E. P. ALEXANDER, dated Georgetown, S. C., September 12, 1900.

The recent tragedy at Galveston has interested me deeply, not only for its human interest, but as throwing fresh light on the studies I made of the conditions of danger and safety in such gales in 1893 and 1894 in this vicinity, and I gladly accept the kind invitation to say a few words on the subject.

Clearly, our sea coasts are full, everywhere, of people living in what I called the zone of danger, and utterly oblivious of the precautions necessary to secure safety of life and property, even though they are generally simple and inexpensive.

Possibly Galveston may have experienced greater destructive forces than were developed in the South Carolina gales of 1893, but it would need the careful observations and measurements of experts to determine the fact. The maximum that we had here, at South Island, Georgetown, S. C., was a barometric depression in the center of less than two inches and a rate of fall never greater than about one one-hundredth of an inch a minute. This produced a wind velocity of probably one hundred and twenty miles an hour, as the maximum rate of short puffs, and a storm wave about eight and one-half feet above the level of ordinary high water. I mean by that, that much elevation of the sea level. Of course the actual billows reared their crests and sent their water much higher than that, and left flotsam which would mislead ordinary observers into believing that the sea had risen twelve or fifteen feet. But in none of the reliable official records which I could find in a search which I kept up for some years, covering all the principal lake and Atlantic ports, could I discover anywhere a higher figure than eight and one-half feet. I have, therefore, always taken that level above ordinary high water as limiting the zone of danger or the possible rise of the ocean level. As to the destructive power of the wind, my experience here was that it was never enough, of itself alone, to seriously injure any well built structure of ordinary size. By well built, I mean mortised and tenoned, well secured on firm foundations, and roofed with shingles. Such houses a century old nearly, and in exposed situations, are standing here to-day, and there are many examples, too, of

even flimsy constructions being made to stand by temporary props if only the foundations were good.

It will be extremely interesting to have an expert's report upon what conditions determined safety, what wrought destruction at Galveston, and how things that were destroyed could have been saved. It seems to me that the Weather Bureau could render no greater service than to have such a study made very carefully. A diagram of the barometer, the wind, and the water, such as I made of the Carolina storms, would be very valuable.

There is also one other suggestion which I think the experiences of this storm demonstrates to be of such great importance that, in spite of every possible difficulty, it should be adopted and carried into effect as far as can be done. It is to organize a system of warnings by sound signals along the sea coast, not in the interior, for there the danger to life is small, but in the zone of danger. I suppose rocket bombs such as the rain-makers used would be cheapest and easiest to work to give the signal. Only one signal should be used, "caution;" two would cause confusion. That is one trouble now with the flag system; there is more of it than the average man will remember, but he can remember that the bombs mean caution. He can then fill his jugs with water, cover his cisterns and wells (lest the salt spray poison them), prop his house, drive his stock to high places, anchor down his farm bridges, tie up his boats, and prepare some refuge above the zone of wave action for his family.

I live and plant rice within this zone, and I have a very vivid appreciation of the value of every hour of warning, when it can be given, when the gale is sure to come. Warnings given when it is uncertain may do harm by discrediting those to come in the future.

#### THE WEATHER BUREAU OF JAPAN.

By F. B. WRIGHT.

Mr. Frank Bennett Wright, who was until recently a "student assistant" at the Baltimore station of the Weather Bureau, is now traveling in the Orient with his father, the well-known geologist, and author of *The Ice Age*. He communicates from Tokio the following interesting note to the May report of the Maryland section of the Climate and Crop service:

In Maryland it is hard to realize that Japan is equipped with meteorological observatories which would do credit to any of our American cities. In respect to agriculture and forestry Japan far surpasses us. All the hillsides, where it is possible, are terraced with great care, and the small patches thus made produce at least two and often three crops a year, first a grain, such as wheat or barley, then rice, and lastly vegetables of some kind. Hillsides that are steep, or are composed of too poor soil for this, are set out with pine trees. There is no place, except Holland, where the land is in such a high state of cultivation. This has been the case for centuries, but the aid given the farmers by the weather bureau reports and forecasts is a blessing that has come with the recent Japanese awakening.

Besides the central office at Tokyo there are seventy substations which furnish data for the weather map and forecast issued every day at 2 p. m. This bulletin contains much the same facts as ours, but has three maps showing the weather changes during the preceding twenty-four hours.

At Mayebashi I visited the office, which is located just outside of the town, and was shown the apparatus and methods of work. In some respects it is better equipped than those of similar importance in the United States, but not as well in others. Nearly all the instruments are of German make.

The observers here are worked rather hard, for eye observations of the air temperature and the wet bulb, the height of the barometer, the direction of the wind, etc., are taken every four hours during both night and day. A record is also kept of the amount of ozone in the air and the temperature of the soil at one, two, and three feet.

One of the most interesting parts of the office to me was the seismograph room. Here in Japan, where earthquakes occur every few days, or oftener, the record of the seismograph is of great interest and importance, although shocks can not be forecast. This instrument